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**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : PHOTONIC DEVICES

COURSE CODE : BEJ 33002

PROGRAMME CODE : BEJ

EXAMINATION DATE : JULY/ AUGUST 2023

DURATION : 2 HOURS

INSTRUCTION

1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

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- Q1** Solar photovoltaic is one of the fastest-growing renewable energy technologies.
- (a) Discuss the energy conversion in solar photovoltaic systems in terms of electrons and energy bands. (6 marks)
  - (b) Thin film is a second-generation technology of solar cells. Explain **THREE (3)** advantages of this technology compared to the first-generation amorphous silicon. (3 marks)
  - (c) Discover **THREE (3)** main challenges in the implementation of solar photovoltaics. (6 marks)
- Q2** (a) Blue Light Emitting Diodes (LEDs) is able to solve energy use and climate change problem by efficient lighting.
- (i) Analyze the suitability of gallium nitride (GaN) to produce blue LEDs. The bandgap of GaN is 3.4 eV. Show all the calculations and parameters involved. (6 marks)
  - (ii) Deduce **ONE (1)** conclusion from the answer in **Q2(a)(i)**. (2 marks)
- (b) Explain **TWO (2)** traditional methods to produce a different colour of light. (2 marks)
- (c) Name **TWO (2)** applications of Light Emitting Diodes (LEDs) in modern transportation systems. (2 marks)
- Q3** (a) Photoresistor is the cheapest type of photodetector compared with photodiode and phototransistor.
- (i) Analyze **THREE (3)** weaknesses of photoresistors over two other photodetectors with the supporting theories. (6 marks)
  - (ii) Photoresistors are usually used as light sensors. Suggest **ONE (1)** application that used phototransistors in their light sensor system. (1 mark)
- (b) A photodetector having an area of  $5 \times 10^{-2} \text{ cm}^2$  is irradiated by red light with intensity of  $20 \text{ mW.cm}^{-2}$ . Assuming that each photon is generated as one electron-hole pairs (EHP), calculate the number of pairs generated per second. Given  $\lambda = 630 \text{ nm}$ . Show all the calculations. (7 marks)

- Q4** (a) Explain the coherence characteristics of the laser using an appropriate diagram. (4 marks)
- (b) In lasers, photons have interacted in three ways with the atoms. List **TWO (2)** of the process. (2 marks)
- (c) Lasers can be used to measure distances and levels and help set out construction works. Discuss the operation of the laser in the surveying process. (3 marks)

**-END OF QUESTIONS-**